REMARKS/ARGUMENTS

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mandelman et al. (US 6,605,838) in view of Wu (US 6,552,382). Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mandelman, Wu in view of Mandelman et al. (US 6,163,045).

1. Rejection of claims 1-10 35 U.S.C. 103(a):

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mandelman et al. (US 6,605,838) in view of Wu. For reasons of record that can be found on pages 2-5 in the Office action identified above, which is part of paper no./mail date 082204.

Response:

The Applicants intend to point out the difference between the amended claim 1 of the present application and Mandelman et al. and Wu. The amended claim 1 of the present application is repeated below:

"1. A vertical dynamic random access memory (DRAM) comprising:

a substrate comprising at least a deep trench having an upper trench portion and a lower trench portion;

a trench capacitor located in the lower trench portion;

a source-isolation oxide layer located on the trench capacitor;

a shallow trench isolation (STI) positioned around the deep trench; and

a vertical transistor located on the source-isolation oxide layer, the vertical transistor comprising:

an annular source set in the substrate next to the source-isolation oxide layer, the annular source being electrically connected to the trench capacitor;

a gate conductive layer filling the upper trench portion and electrically connected to a first contact plug;

a cylindrical gate dielectric layer located on a surface of a sidewall of the upper trench portion and circularly encompassing the gate conductive layer; and

an annular drain circularly encompassing the deep trench near a surface of the substrate, the annular drain being positioned next to the STI and electrically connected to a second contact plug, and being isolated from the annular drains of adjacent vertical transistors by the STI."

According to the claim 1, the present application discloses that an annular drain and an annular source are placed around the deep trench and circularly encompass the deep trench for forming an annular channel to raise the sufficient current, *wherein each annular drain and each deep trench are isolated from other drains of adjacent vertical transistors and other deep trenches, and each annular drain and deep trench are encompassed by the STI having an annular structure.*

Referring to the disclosure of Mandelman et al. (US 6,605,838), although they also teach an annular source and an annular drain to encompass the deep trench, the drain is a common drain (denoted by 52 in Fig.2) to two vertical transistors of two deep trenches. Referring to Wu and Mandelman et al. (US 6,163,045), they only disclose non-annular drains, and therefore, the non-annular drains cannot cause annular channels for each vertical transistor of each deep trench. *Accordingly, none of Mandelman et al., and Wu disclose the structure of a separate vertical transistor in a deep trench having an annular drain which is isolated and encompassed by an annular STI, and they are silent about*

teaching an annular STI to encompass each vertical transistor in each deep trench.

On the other hand, since the annular STI of this application encompasses each vertical transistor, *the STI (46) and P-type well (112) form a vertical silicon on insulator (vertical SOI) that has advantages of improving the short channel effect of vertical transistors and preventing deep trench leakage; while the disclosed transistor structures of Mandelman et al. and Wu cannot provide these advantages.*

Therefore, the applicants believe the vertical DRAM of this application is quite different from the DRAM structures disclosed by Mandelman et al. and Wu. Reconsideration of the amended claim 1 is hereby requested.

Referring to claims 4 and 5 of this application, the Examiner points that Mandelman et al. teach a buried strap (86) for electrically connecting the annular source and the storage node, wherein the buried strap is an annular conductive strap located on the surface of the sidewall of the lower trench portion above the capacitor dielectric layer (66). However, referring to the specification of Mandelman et al., *the buried strap (86) is a diffusion region and positioned out of the trench region (56), wherein the buried strap 86 acts as a source of the vertical MOSFET (80), which can form channel with the drain (52)*, as shown in Fig.2 and colon 8, lines 49-67. In contrast to Mandelman et al., *the buried strap (denoted by 126' in Fig.1) of this application is positioned on the inner surface of the sidewall of the deep trench (120) and functions as a conductive element for electrically connecting the annular source (128) and the storage node (124'), thus the buried strap (126') and the source (128) are different elements.* Therefore, the Applicants consider the rejection of claim 4 and claim 5 is not reasonable. For clearly describing the structure of this application, the claim 5 is amended. Reconsideration of claim 4 and amended claim 5 is hereby requested.

Since claims 2-3 and 6-10 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of the claims 2-3, 6-10 is hereby requested.

2. Rejection of claims 11 35 U.S.C. 103(a):

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mandelman, Wu in view of Mandelman et al. US patent No. 6,163,045 for reasons of record, as recited on page 5 of the above-indicated Office action.

Response:

The introduction of "STI" is added in the amended claim 1, and therefore claim 11 is amended by adding the limitation of the position of the STI for clearly define the STI, as shown in the "Amendment to the Claims" section. No new matters are introduced. *According to the amended claim 11, the annular STI encompasses the annular drain (136) and the annular source (128) without overlapping the deep trench.* Referring to the disclosure of Mandelman et al. (&S 6,605,838), the drain (52) is disposed between and around two trench regions (56), and no STI is shown. Therefore, Mandelman et al. do not teach about positioning a STI surround the annular source (86) and the drain (52). Referring to the specifications and figures of Wu and Mandelman et al. (6,163,045), both the STI (323b of Wu) and STI (380 of Mandelman et al.) overlap portions of the deep trenches. *Accordingly, none of the three prior-art disclosures teach the vertical DRAM with a STI surround and encompass the annular source and the annular drain without overlapping the deep trench region in this application.*

On the other hand, since the amended claim 11 is dependent upon the amended

claim 1, it should be allowed if the amended claim 1 is allowed. Reconsideration of the amended claim 11 is politely requested.

3. Addition of new claims 12-13:

Claims 12 and 13 are added as shown in the "Amendment to the Claims" section for more specifically describing the vertical DRAM according this application (see Fig.1 and paragraphs [0015]-[0016], and [0024]). Since the vertical DRAM 168 of this application has an annular spacer (150) and an asymmetric second contact plug 156, there is an advantage that the vertical DRAM structure can be fabricated by a self-alignment process, which does not taught in the prior arts cited by the Examiner. No new matters are introduced. Consideration of the new claims 12-13 is thereby politely requested.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Sincerely yours,

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